

CLAIMS

What is claimed is:

1. A process for drawing a gel-spun multi-filament yarn comprising the steps of:
 - 5 a) forming a gel-spun polyethylene multi-filament feed yarn comprising a polyethylene having an intrinsic viscosity in decalin at 135°C of from 5 dl/g to 35 dl/g, fewer than two methyl groups per thousand carbon atoms, and less than 2 wt. % of other constituents;
 - b) passing said feed yarn at a speed of V_1 meters/minute into a forced convection air oven having a yarn path length of L meters, wherein one or more zones are present along the yarn path having zone temperatures from 130°C to 160°C;
 - 10 c) passing said feed yarn continuously through said oven and out of said oven at an exit speed of V_2 meters/minute wherein the following equations are satisfied

$$0.25 \leq L/V_1 \leq 20, \text{ min}$$

$$1.5 \leq V_2/V_1 \leq 20$$

$$1 \leq (V_2 - V_1)/L \leq 60, \text{ min}^{-1}$$

$$0.55 \leq 2L/(V_1 + V_2) \leq 10, \text{ min}.$$
- 20 2. The process of claim 1 additionally satisfying the condition that the mass throughput of yarn passing through the oven is at least 0.25 grams/minute per yarn end.
3. The process of claim 1 wherein the yarn is drawn at constant tension throughout the oven neglecting the effect of air drag.
- 25 4. The process of claim 1 wherein the yarn is drawn at increasing tension through the oven.
5. The process of claim 1 wherein the feed yarn comprises a polyethylene having an intrinsic viscosity in decalin at 135°C of from 8 dl/g to 30 dl/g, fewer than one methyl groups per thousand carbon atoms, and less than 1 wt. % of other constituents, said feed yarn having a tenacity from 6 to 76 g/d as measured by ASTM D2256-97.
- 30 6. The process of claim 5 wherein the feed yarn has a tenacity from 11 to 66 g/d.

7. The process of claim 5 wherein the feed yarn has a tenacity from 16 to 56 g/d.
8. The process of claim 5 wherein the feed yarn has a tenacity from 21 g/d to 51 g/d.
- 5 9. The process of claim 5 wherein the feed yarn has a tenacity from 26 g/d to 46 g/d.
10. The process of claim 5 wherein the feed yarn comprises a polyethylene having an intrinsic viscosity in decalin at 135°C of from 10 dl/g to 25 dl/g.
- 10 11. The process of claim 5 wherein the feed yarn comprises a polyethylene having an intrinsic viscosity in decalin at 135°C of from 12 dl/g to 20 dl/g, fewer than 0.5 methyl groups per thousand carbon atoms, and less than 0.5 wt.% of other constituents, said feed yarn having a tenacity from 21 to 51 g/d.
- 15 12. A process for drawing a gel-spun multi-filament yarn comprising the steps of:
 - a) forming a gel-spun polyethylene multi-filament feed yarn comprising a polyethylene having an intrinsic viscosity in decalin at 135°C of from 5 dl/g to 35 dl/g, fewer than two methyl groups per thousand carbon atoms, and less than 2 wt.% of other constituents;
 - 20 b) passing said feed yarn at a speed of V_1 meters/minute into a forced convection air oven having a yarn path length of L meters, wherein one or more zones are present along the yarn path having zone temperatures from 130°C to 160°C;
 - 25 c) passing said feed yarn continuously through said oven and out of said oven at an exit speed of V_2 meters/minute wherein the following equations are satisfied

$$1 \leq L/V_1 \leq 20, \text{ min}$$

$$1.5 \leq V_2/V_1 \leq 20$$

$$0.01 \leq (V_2 - V_1)/L \leq 1, \text{ min}^{-1}$$

$$30 \quad 1.1 \leq 2L/(V_1 + V_2) \leq 10, \text{ min}.$$
13. The process of claim 12 additionally satisfying the condition that the mass throughput of yarn passing through the oven is at least 0.25 grams/minute per yarn end.

14. The process of claim 12 wherein the yarn is drawn at constant tension throughout the oven neglecting the effect of air drag.
15. The process of claim 12 wherein the yarn is drawn at increasing tension through the oven.
- 5 16. The process of claim 12 wherein the feed yarn comprises a polyethylene having an intrinsic viscosity in decalin at 135°C of from 8 dl/g to 30 dl/g, fewer than one methyl groups per thousand carbon atoms, and comprising less than 1 wt.% of other constituents, said feed yarn having a tenacity from 5 to 76 g/d as measured by ASTM D2256-97.
- 10 17. The process of claim 12 wherein the feed yarn has a tenacity from 11 to 66 g/d.
18. The process of claim 12 wherein the feed yarn has a tenacity from 16 to 56 g/d.
19. The process of claim 12 wherein the feed yarn has a tenacity from 21 to
15 51 g/d.
20. The process of claim 12 wherein the feed yarn has a tenacity from 26 to 46 g/d.
21. The process of claim 12 wherein the feed yarn comprises a polyethylene having an intrinsic viscosity in decalin at 135°C of from 10 dl/g to 25 dl/g.
- 20 22. The process of claim 12 wherein the feed yarn comprises a polyethylene having an intrinsic viscosity in decalin at 135°C of from 12 dl/g to 20 dl/g, fewer than 0.5 methyl groups per thousand carbon atoms, and less than 0.5 wt.% of other constituents, said feed yarn having a tenacity from 21 to 51 g/d.
- 25 23. A gel-spun polyethylene multifilament yarn drawn by the process of claim 1.
24. A gel-spun polyethylene multifilament yarn drawn by the process of claim 12.